



PLANETARY SCIENCE TECHNOLOGY REVIEW PANEL

Mars Technology Program

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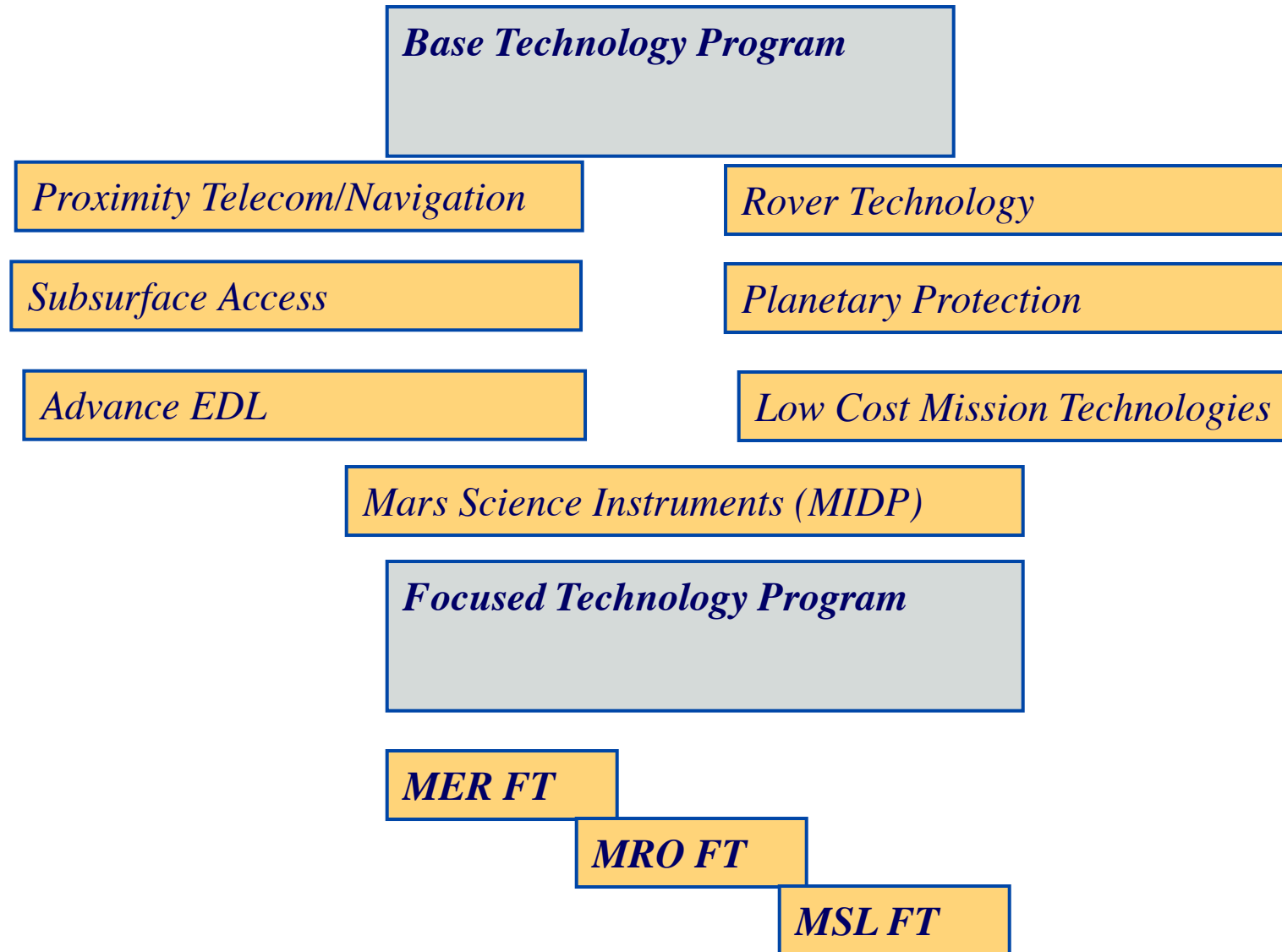


Program Objectives/Purpose

- When NASA restructured the Mars Exploration Program, it was decided to include a strong technology program component to enable increasingly more capable missions and science
- The restructured program includes ~5 - 10% investment in technology averaged over five years.
- Program elements:
 - **Base Technology**
 - Technology advances for multiple missions
 - Low TRL
 - Competed via NRAs
 - **Focused Technology**
 - Technology is aimed at advancing enabling technologies to TRL 6 by the PDR of specified missions.
 - Missions manage focused technologies, with MTP oversight, with flight project discipline, including cost, schedule, and reviews.

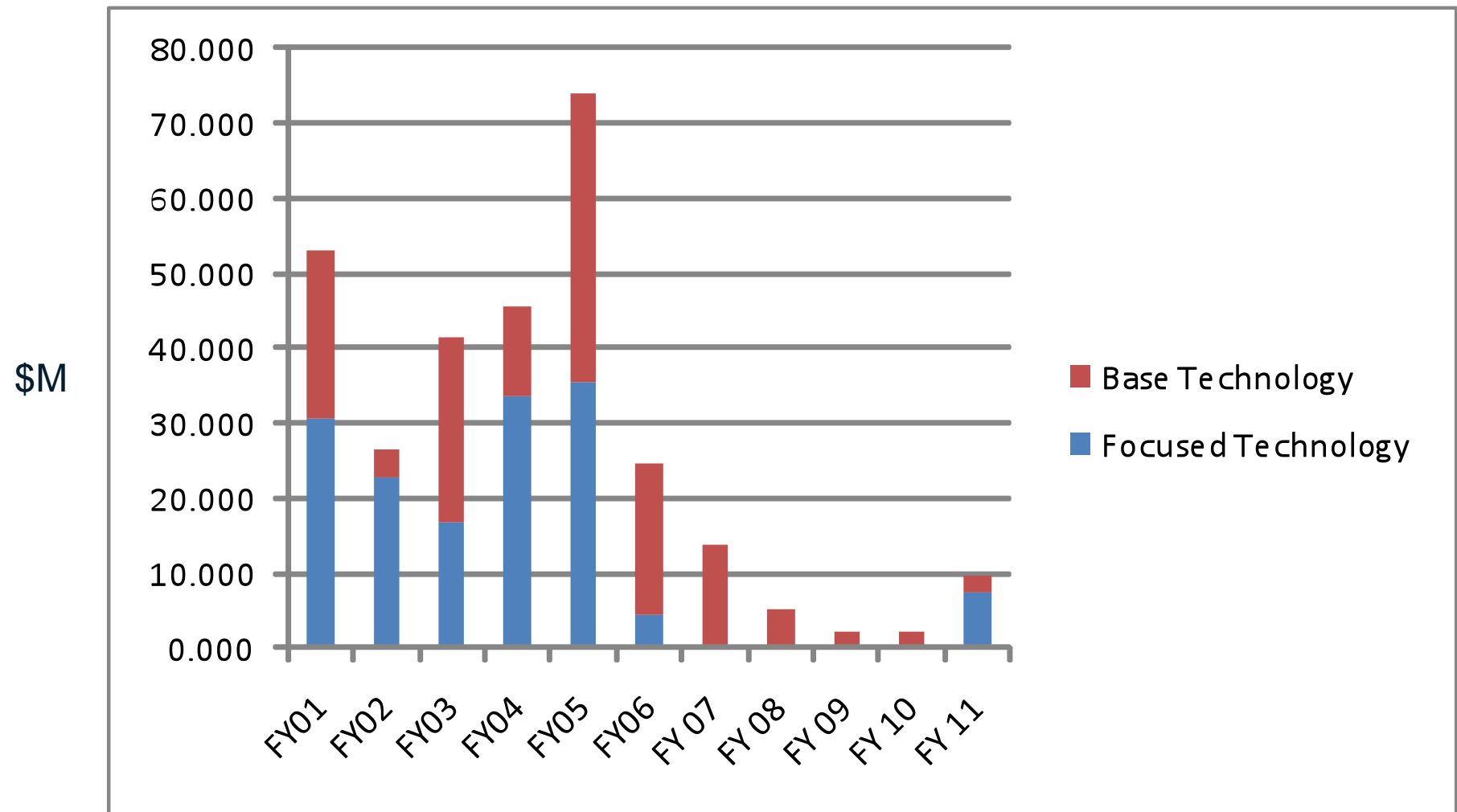


Brief Summary of Program Content





Resource Summary and Utilization



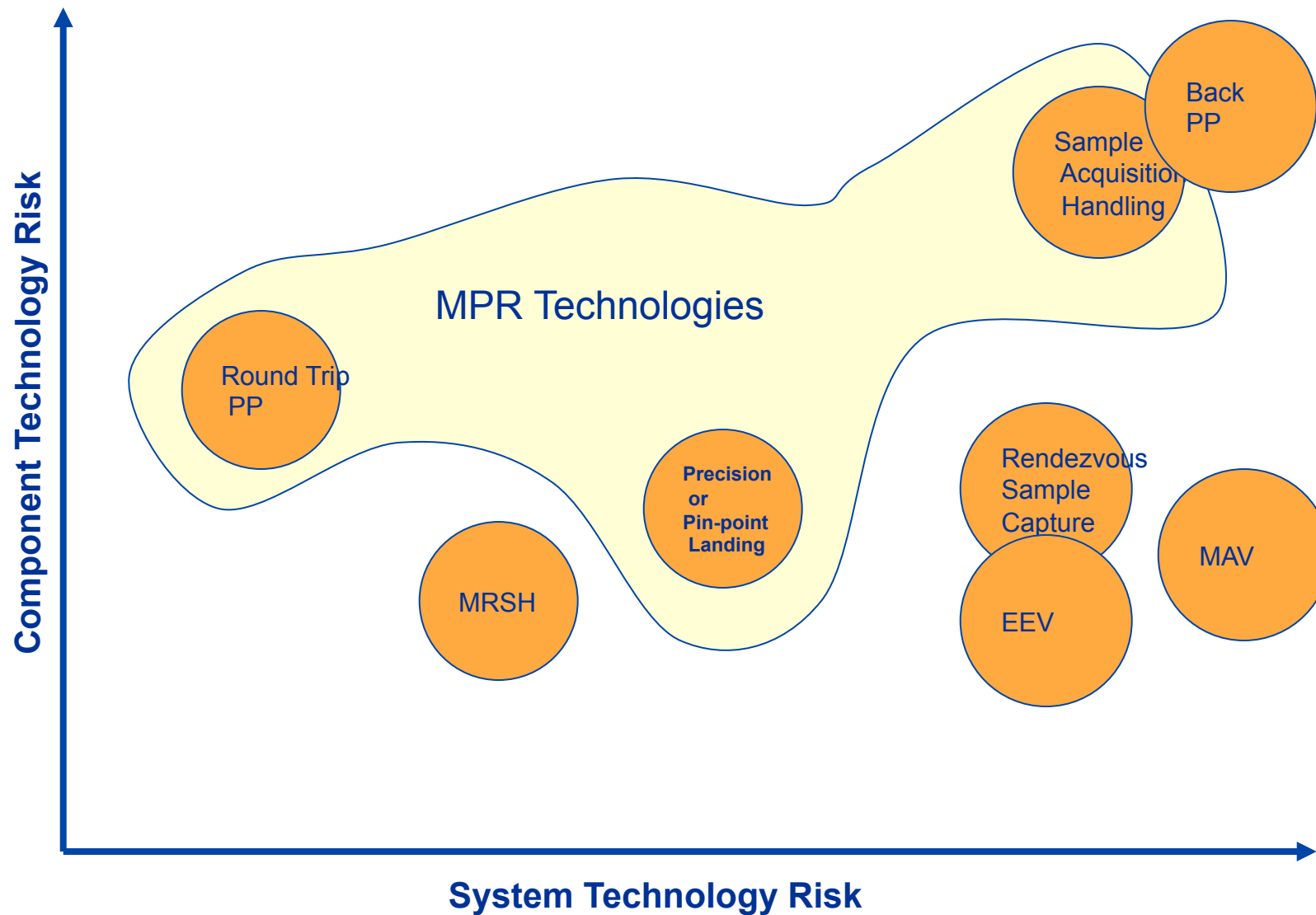


Summary of Future Plans

- Base technology has been discontinued despite its success! (Current budget is ~\$2M and is used for technology studies, maintenance of testbeds, etc.) Some technologies developed in the base program have actually been infused into Mars missions, even though that was not the immediate objective.
- Focused technology is planned for 2018 and MSR missions
- MAX-C focused Technology: 2011-2014, \$85M (FY '15\$)
- MSR Technology, 2016-2021, \$410M (FY '15\$)

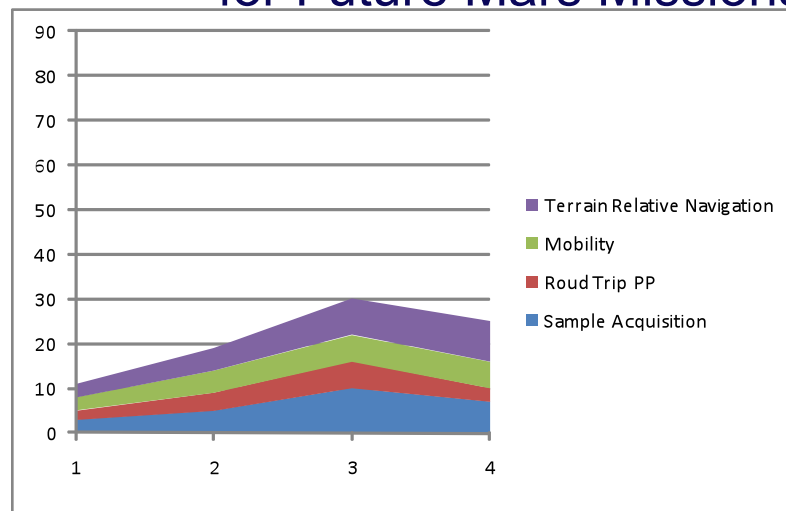


Future Technologies and Risks

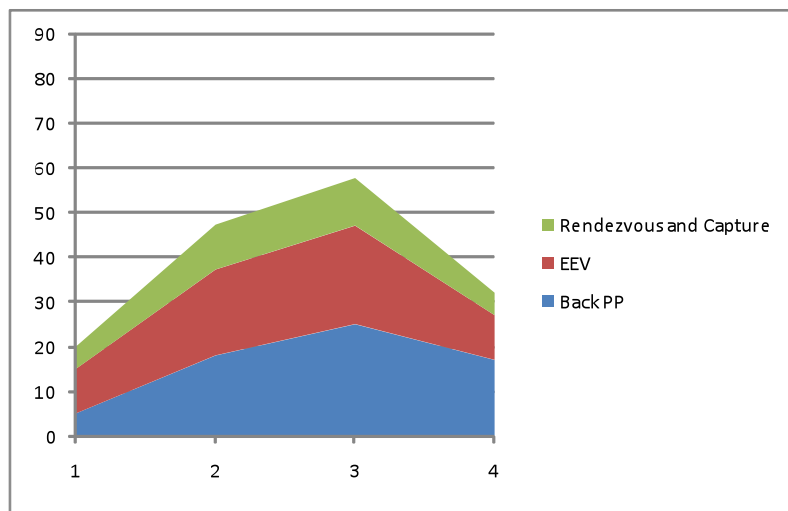




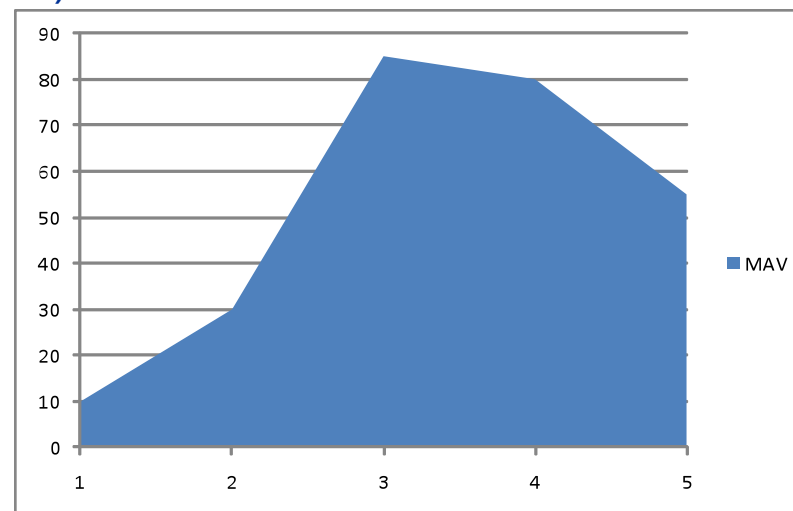
Estimated Technology Cost Including 50% Reserve (\$M) for Future Mars Missions



MAX-C (\$85M)



MSR Orbiter (\$160M)



MSR Lander (\$250M)

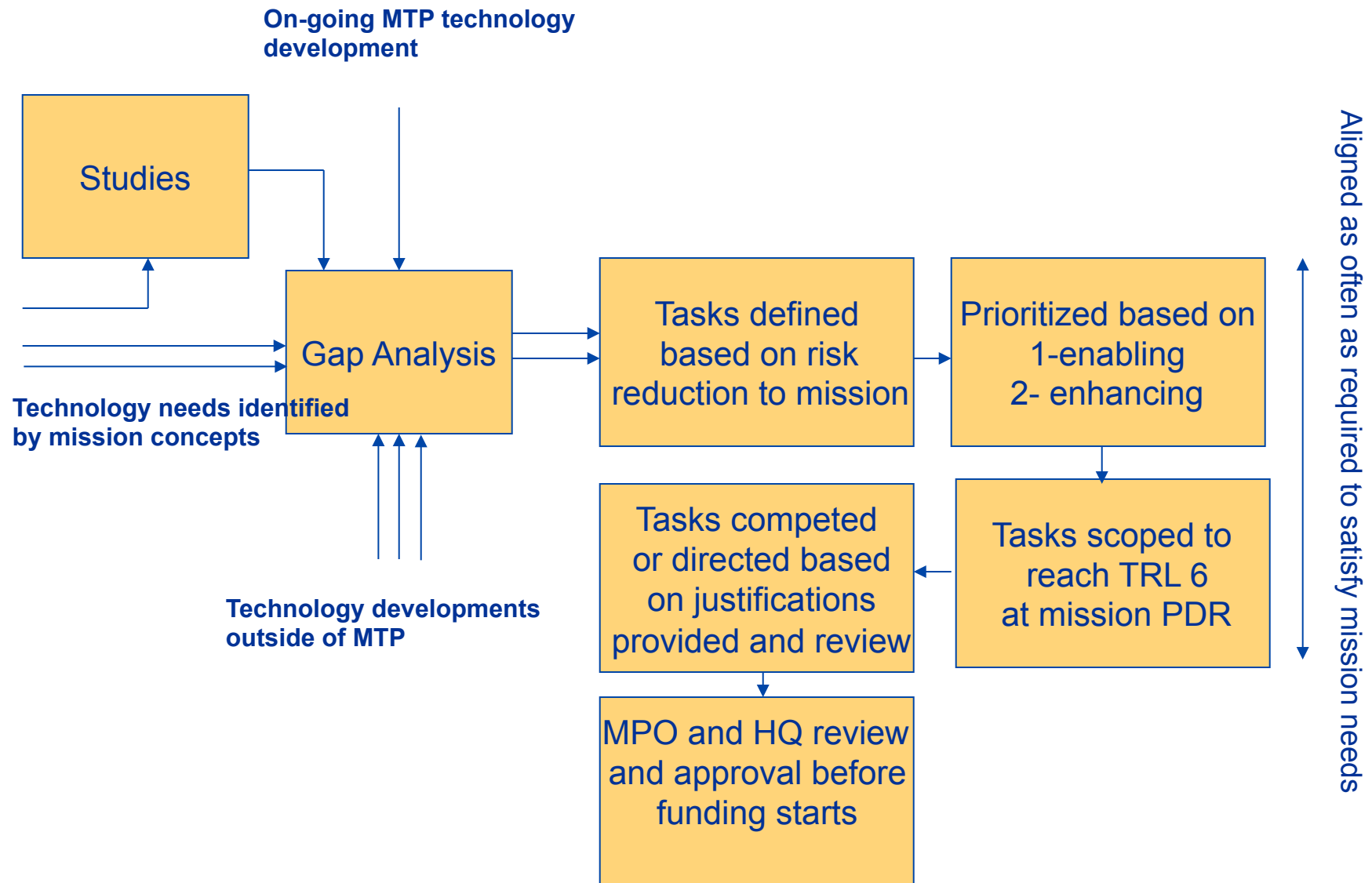


Decision Making Processes Used





Focused Technology Program Task Selection Process





Evolution of Program

(and Major Contributing Factors)

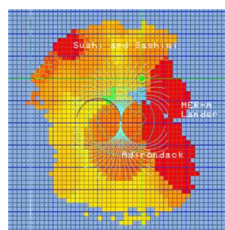
- Technology Program's funding has been reduced
 - MSL cost overruns has been the major factor in reduction of funding for the Mars Technology Program
 - Other major factor is the reduction of the Mars Program budget starting in FY '09



What has Flown and what enabled it to do

SO

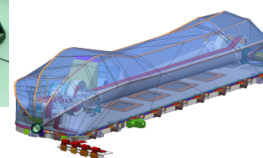
<i>Technologies Infused</i>	<i>MER</i>	<i>MRO</i>	<i>Phoenix</i>	<i>MSL</i>
	17	2	3	22 at PDR (21 continued)



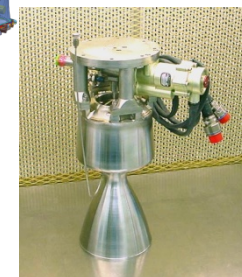
GESTALT



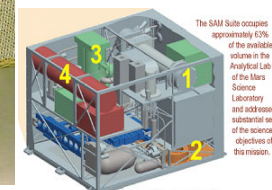
*Electra
Radio*



Bio-Barrier



MSL MLE

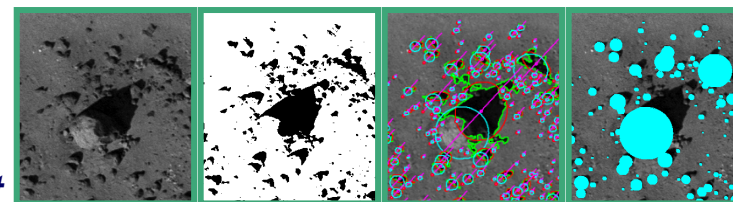


SAM

Infusion Success Factors:

- *Mission pull*
- *Excellent task manager, flight project familiarity*
- *Mission participation*
- *Successful development within schedule*

Rock Count



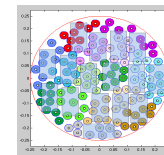


What Did and Did Not Work and Why

- *Three important factors are:*

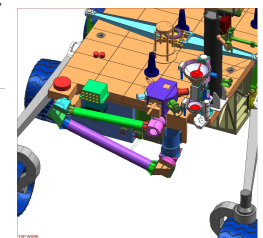
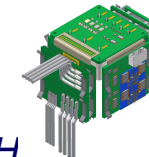
- *Changes in mission architecture*

- *Phased Array Terrain Radar: pallet lander instead of sky crane*
- *Mission Data System: MSL would use MER software*
- *Subsonic Parachute: Slightly larger supersonic parachute*



- *Technology not ready by PDR:*

- *Integrated light-weight actuator-gearbox-electronics:*
 - *Life test failed post PDR*
- *Sample Processing / Sample Processing and Handling (SA/SPaH),*
 - *New requirement after science instrument for rock crusher*
 - *Corer not at TRL 6*



- *No technology pull*

- *A ~50 gram micro-sun sensor has not been selected by MSL. Instead, MSL would use a 500 gram already flown sun sensors*

